

ESSENTIALS OF
MEDICAL ANATOMY

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H. R. KENWOOD

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THE ESSENTIALS
OF
MEDICAL ANATOMY.

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P R E F A C E.


I COMPILED the greater part of the material of this little Manual while a student; and the fact that it was eagerly copied and appreciated by some of my co-students, has encouraged me to publish it.

My object has been to keep the book within the limits of a pocket manual, to facilitate reference; and, for that reason, I pre-suppose a good knowledge of general anatomy, and only give so much of "medical" anatomy as it is essential to know.

All diagrams have been purposely excluded, for each organ can be mapped out (from the information supplied in the Manual), by a soft crayon, on the living subject. Such a diagram is far easier remembered, and the practical manner in which the work is thereby learnt, amply repays one.

The notes on "Relative Anatomy" have been compiled from Quain's and Gray's Anatomy.

H. R. K.



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THE ESSENTIALS OF MEDICAL ANATOMY.

INTRODUCTORY.

THE exact position of any organ, relatively to the parietes, is determined by means of four methods of examination—inspection, palpation, percussion, and auscultation ; and it is advisable to adopt each of these methods in a routine manner. The order in which they are written is the most convenient.

Inspection.—Place the patient in a good light, and in a convenient position. That most generally convenient for all the four methods of examination is the supine one ; but where it is necessary to change this, to facilitate the examination, it will be mentioned through the book. It is a purely ocular examination, but it requires careful self-tuition, by which the student will find that he grows to notice more and more.

Palpation.—It is only by much practice, and careful education of the sense of touch, that one can reap the best results from this method. The hand should be always warm, and placed *flat* (don't use the tips of the fingers !), with even and gradually increasing firm pressure, upon the part to be palpated.

first and second dorsal spines), and the lower angle to the inferior border of the seventh rib.

The top of the sternum is on a level (during expiration) with the disc between the second and third dorsal vertebræ, and the base of the xiphi-sternum with the lower part of the ninth dorsal vertebra.

The nipple, in the male, is generally in the fourth interspace.

The diaphragm, at the end of a full inspiration, reaches to the level of the lower margin of the sixth cartilage in the mid-sternal line, the lower margin of the seventh rib in the mid-axillary line, in the scapular line to the ninth, and in the spinal groove to the eleventh.

On the back the first vertebral spine to appear is usually that belonging to the seventh cervical vertebra, but sometimes the sixth is long, and comes to the surface; the most prominent spine is that of the first dorsal.

The contents of the thorax which chiefly concern the physician are, the heart and great vessels, the lungs and pleura.

The heart is situated between the lungs, in the centre of a space bounded on either side by the right and left pleuræ. The anterior mediastinum is the part of this space immediately in front of the heart, the posterior mediastinum the part behind.

The anterior mediastinum is narrow above, the pleuræ coming into contact behind the second piece

of the sternum, and broader below, the pleuræ receding. It is bounded in front by the sternum, with the fifth and sixth and a portion of the seventh left costal cartilages, and by the triangularis sterni muscle; behind it is the pericardium. Its contents are simply some areolar tissue, and two or three lymphatic glands at its lowermost part.

The posterior mediastinum is bounded anteriorly by the pericardium and the roots of both lungs, posteriorly by the dorsal vertebræ below the fourth, laterally by the lungs and pleuræ. Its contents are—the descending aorta, the vagi nerves, the venæ azygos, the thoracic duct, and some lymphatic glands.

The operation of Paracentesis Thoracis is a “medical operation,” and its anatomy should be mentioned here. The trochar is usually entered in the fifth interspace (sometimes the sixth), at the line of insertion of the serratus magnus, or mid-axillary line, or else more posteriorly, *i.e.*, just below the inferior angle of the scapula. It must be remembered that the intercostal artery runs along near the lower border of the upper rib. Unless considerable force is used, the thickened pleura may not be penetrated, but simply driven before the trochar.

“Paracentesis pericardii.” Best point for puncture, 5th left intercostal space, about 2 or $2\frac{1}{4}$ in. from the mid-sternal line.

THE HEART AND GREAT VESSELS.

The heart in general form resembles a blunt cone. It is placed obliquely in the chest, so that nearly two-thirds of it are found on the left side of the mid-sternum ; its broad base being directed upwards, backwards, and to the right, its blunt apex downwards, forwards, and to the left. As it lies *in situ*, its four chambers have the following relative positions :—The right and left auricles form its base ; the right auricle lying anteriorly and to the right, the left wholly posteriorly and to the left (this auricle is covered in front by the interlacement of the aorta and pulmonary arteries). The right ventricle forms the chief part of the anterior surface of the heart, and its right border ; it forms also a small part of the posterior surface, the rest of this consisting of the left ventricle, which, in addition, forms the left border of the heart, and a small part of the anterior surface. The apex is entirely formed by the left ventricle, and is most appreciable over an area one square inch in extent, in the fifth left interspace, two inches from the left margin of the sternum, or half an inch internal to the mammillary line.

Its Position relatively to the Thoracic Wall.—That part of the chest-wall which lies over the heart is called the “*Precordial Region.*” Its greatest measurements are :—vertically, from the second interspace to the

apex beat; horizontally, at the level of the fourth rib, it extends from a vertical mid-sternal line, $1\frac{1}{2}$ inches to the right, and $3\frac{1}{2}$ inches to the left. At the level of the fourth rib there is the greatest transverse dimension of the heart. Here it projects beyond the median sternal line, an average of 8 to 9 centimètres to the left, 4 to the right, according to Luschka.

To delineate the heart accurately, draw a line downwards, from the centre of the second right interspace half an inch from the margin of the sternum, describing as it descends a pronounced curve, the maximum of the bulge being at the level of the fourth right cartilage, where it is one inch from the margin of the sternum. Continue the curve to the lower border of the fifth cartilage, just at its junction with the sternum, and from this point round the base of the sternum to about half an inch outside the apex beat. If the line be carried up from here, with an outward convexity to a point in the middle of the second left space one inch from the sternum, the outline of the heart will have been defined, with the exception of the base. This is got by drawing a transverse line connecting the two free ends of the tracing. Such a line is just below the level of the inferior borders of the second cartilages (right and left), and corresponds posteriorly to the level of the lower part of the body of the fifth dorsal vertebra.

Within these limits—

The Right Auricle lies behind the third, fourth, and fifth cartilages at their sternal ends, their corresponding interspaces, and the right edge of the sternum.

The Left Auricle extends from just below the lower border of the second left costal cartilage to the upper margin of the sternal end of the fourth' ("upper border of the third cartilage," Jaccoud).

The Right Ventricle reaches from the third to the sixth left cartilages.

The Left Ventricle extends from the upper border of the third left cartilage to the middle of the fifth, or even to the sixth rib. Its external border corresponds nearly enough to the line of insertion of the ribs (from the third to the sixth) with their cartilages.

The Position of the Valves.—The position of the *mitral valve* corresponds to a line drawn through the sternal end of the third left costal cartilage, at a distance of about two-thirds of an inch from its junction with the sternum, and reaching from the upper margin of the cartilage down the intercostal space beneath.

The Tricuspid Valve corresponds to a line drawn obliquely across the sternum, in the direction of, from the lowest part of the third left intercostal space to the fifth right costal cartilage; the two ends of which line would not quite reach the lateral margins of the sternum. The valve is, therefore, on a level with the fourth space.

The Aortic Valves lie horizontally, and correspond to a line drawn from the middle of the junction of the third left costal cartilage to the mid-sternum.

The Pulmonary Valves lie parallel to the aortic, but slightly higher, and more to the left, being on a level with the upper border of the third cartilage (left).

The sounds produced at these orifices are best heard, however, *not* immediately over them, but over an area on the chest-wall, where the cavity receiving the vibrating blood, approaches nearest the surface.

Mitral sounds are best heard over an area an inch in diameter over the apex beat, for it is only here that the left ventricle comes in contact with the chest-wall.

Tricuspid.—Over the lower part of the sternum, particularly the left border, from the fourth to the sixth cartilages.

Aortic.—The aorta reaches nearest the chest-wall, opposite the second right costal cartilage, and therefore the “aortic area” is here.

The Pulmonary is over the third left costal cartilage, or slightly higher.

The limits of the organ are ascertained by percussion, and the clinically appreciable limit falls a little short of what anatomy teaches us. The greater part of the heart is covered anteriorly by the lungs, and over this, therefore, only a “relatively” dull note can be got; a small part, however (consisting of the right

ventricle), is uncovered by lung, and an "absolutely" dull note is obtainable. The "*area of absolute cardiac dulness*" is irregularly triangular, and "its greatest dimension, either in height or length, is between $1\frac{1}{2}$ and 2 inches (40–54 millimètres)" (Jaccoud). It of course varies somewhat with respiration, but in quiet breathing, the base of the triangle runs a little to the right of the midsternal line, from the fourth to the sixth costal cartilages. A line stretching irregularly from the upper end of the base to the apex-beat, forms one side of the triangle; the other side can only be got approximately, owing to the liver dulness encroaching on that of the heart below; but the triangle can be sufficiently correctly finished by drawing a line from the level of the upper margin of absolute hepatic dulness, on the right side, to the apex-beat. It is not necessary, generally speaking, to map out *exactly* the "*relative cardiac dulness*," for percussion in two directions suffices in the majority of cases—first, along the line of the fourth rib, and secondly, in a vertical direction, parallel to the sternum, and about one inch to the left of its margin (to avoid the aorta). The left margin of the heart is marked accurately enough, for most cases, by the position of the apex-beat; the right margin is usually nearly one inch to the right of the margin of the sternum. Percussing from above downwards, the lung note gets impaired

no higher than the lower edge of the third cartilage, whereas the heart reaches nearly to the height of the lower border of the second cartilages.

It is important to remember the anatomy of the *Great Vessels in the Thorax*, in order to account for the various symptoms of aneurism, etc., and the student is often asked about them in his final examinations in medicine. They will therefore be included here.

Their relative positions to the chest-wall are :

The Aorta, tracing it from the positions of its valve (*vide ante*), ascends to the right of the sternum, opposite the second cartilage, and then, crossing the middle line one inch above the supra-sternal notch, where it lies on the bifurcation of the trachea, it returns to the left side, and descends to reach the back, opposite the fourth dorsal vertebra. The aortic dulness exists, in the normal condition, only as a small rounded projection, from the upper border of the relative cardiac dulness ; it rises as high as the upper margin of the second costal cartilage.

Opposite the middle of the manubrium, the *Innominate* and *Left Common Carotid* arteries arise, close together from the aortic arch, and run upwards, the innominate to the right, and the carotid to the left sterno-clavicular articulation.

The arterial cone, from whence emerges the pulmonary artery, ascends along the left border of the sternum,

from the middle of the third left space to the middle of the second.

The Subclavian artery nominally rises about one inch above the clavicle.

The Superior Vena Cava courses up to the right side of the aortic arch, behind the sternal ends of the first and second intercostal spaces.

The Left Innominate Vein, running along the top of the aortic arch, is just below the upper margin of the sternum.

Sometimes in children the left innominate vein is visible in the neck, the arch of the aorta being higher than usual.

OF THE AORTIC ARCH, the most important relations of the vessels are :

The Ascending Portion.—At its commencement, it is in contact anteriorly with the root of the pulmonary artery, and with the right auricular appendix, but higher up, as it ascends to the right, it approaches very near the sternum, being only separated by the pericardium, the right pleura, and by the thin anterior margin of the right lung. On the right side is the superior vena cava, and, lower down, the right auricle. On the left, the root of the pulmonary artery. The right pulmonary artery and root of the right lung forming its posterior relations.

The Transverse Portion is covered, more on the left

side than on the right, by the pleura and lung, and is placed immediately in front, and to the left of the trachea, the œsophagus, and thoracic duct. Running along its upper border is the left innominate vein, and from here are given off the large branches of the innominate, the left carotid, and left subclavian. The lower concave border of this portion overhangs the bifurcation of the pulmonary artery, and is connected with the left branch of that artery by the obliterated ductus arteriosus. It is crossed in front by the left vagus, left phrenic, and superficial cardiac nerves, as well as by the left superior intercostal vein; and the recurrent laryngeal nerve turns upwards, beneath and behind it.

The Descending Portion rests against the left side of the body of the fifth dorsal vertebra, and is covered by the left pleura and lung. To the right side of this part of the aortic arch, is the œsophagus, with the thoracic duct.

The Innominate Artery (from $1\frac{1}{2}$ to 2 inches in length) ascends obliquely to the right sterno-clavicular articulation. It is separated from the sternum by the sterno-hyoid and sterno-thyroid muscles, and the remains of the thymus gland; and, lower down, by the left innominate vein, which crosses the artery at its root. Its lower part lies in front of the trachea, the upper against the pleura; on its left side is the left carotid

artery below, and the trachea above ; and to the right is the corresponding innominate vein.

Part of the left common carotid, and the left subclavian arteries, lie in the thorax, and their relations there are :

The Thoracic Part of the Left Common Carotid.—It ascends obliquely behind, and at some distance from the upper piece of the sternum, and the sterno-hyoid and sterno-thyroid muscles ; it is covered in front by the remains of the thymus, and is crossed by the left innominate vein. This part of the artery lies at first over the trachea, and then over the œsophagus. The thoracic duct is also behind it. The vagus is to its outer side.

The Thoracic Part of the Left Subclavian Artery.—It is at first overlapped by the left lung, and is covered in front, and on the left side, by the pleura ; it rests, for a little, on the œsophagus, and the thoracic duct. To the right side of the vessel is, at first, the trachea, and, higher up, the œsophagus, and thoracic duct. The left innominate vein is anterior to it, and passing down in front is the left vagus. The phrenic nerve descends to the left of this part of the artery.

The Pulmonary Artery.—The main pulmonary artery arises from the right ventricle, and passes for two inches upwards and backwards to the concavity of the aortic arch, where it divides. On each side, at its

commencement, is the corresponding coronary artery, and close to its sides, the two auricular appendages. It at first lies in front of the origin of the aorta, but higher up, where it lies in front of the left auricle, it passes to the left side of the ascending aorta, and is finally placed below the transverse portion of the arch. The obliterated ductus arteriosus connects it with the under surface of the aortic arch. The right pulmonary artery runs nearly transversely to the right, behind the ascending aorta and superior vena cava, into the root of the right lung, where it divides. The left passes horizontally in front of the descending aorta and left bronchus, into the root of the left lung.

The Descending Thoracic Aorta extends from the lower margin of the fifth dorsal vertebra, on the left side, to the front of the last dorsal vertebra, and has therefore a general inward inclination in its whole length. It lies in the posterior mediastinum, resting against the spine, and covered in front by the root of the left lung and the pericardium; on the left side, it is in contact with the corresponding pleura and lung; and close to it, on the right side, are the azygos vein, the thoracic duct, and the œsophagus. The œsophagus, however, towards the lower part of the thorax, is in front of the artery, and near the diaphragm gets somewhat to the left side. The small azygos vein lies behind the descending thoracic aorta.

Course and Relations of the Œsophagus.—The œsophagus, from its commencement, opposite the sixth cervical vertebra, inclines at first somewhat to the left, but regains the middle line, opposite the fifth dorsal vertebra, and finally deviates once more to the left, terminating opposite the tenth or eleventh dorsal vertebra, by opening into the stomach.

That *part in the neck* has in front the trachea, and lower down, the thyroid gland and thoracic duct. Behind, it lies against the longus colli muscle, while on either side are the common carotids, and the recurrent laryngeal nerves, coursing up between it and the trachea.

That *part in the thorax* has in front of it, from above downwards, the trachea, the left carotid and subclavian arteries, and the arch of the aorta, the left bronchus, the posterior surface of the pericardium. Behind, the longus colli muscle, below this the intercostal vessels, and near the diaphragm, the front of the aorta, separate it from the vertebral column. Laterally it is covered by pleura, and has the vena azygos major on the right side, and the descending aorta on the left.

The right vagus passes down behind it, the left in front of it.

THE LUNGS.

When dealing with the lungs it is necessary, to facilitate localisation and reference, to map out the thorax into a series of small regions. These are :

I. *A Median or Sternal Group*, bounded on each side by the lateral border of the sternum.

- a. The supra-sternal notch.
- b. The superior sternal region.
- c. The inferior sternal region.

The latter two are separated by a line along the level of the lower border of the third costal cartilage.

II. *An Antero-Lateral Group*, bounded internally by the lateral sternal border, and externally by a line which commences at the first ring of the trachea, and runs diagonally outwards to the acromion process, and then falls vertically downwards.

- a. The supra-clavicular region.
- b. The clavicular—corresponds to the inner half of clavicle.
- c. The infra-clavicular—from the clavicle to the lower border of the third rib.
- d. The mammary—from the lower border of the third rib to the sixth rib.
- e. The infra-mammary—from the sixth rib downwards.

III. *The Lateral Group* corresponds to the axilla, being bounded anteriorly by the vertical acromion line, which limits the antero-lateral group, and posteriorly by the axillary border of the scapula.

a. Axillary region.

b. Infra-axillary—separated from the former by a horizontal line at the level of the sixth rib.

IV. *The Posterior Group*.—Bounded externally by the axillary border of the scapula, and internally by the middle line posteriorly.

a. Supra-scapular.

b. Supra-spinous—corresponds to supra-spinous fossa.

c. Infra-spinous—corresponds to infra-spinous fossa.

d. Infra-scapular.

e. Inter-scapular.

The Position of the Lungs relatively to the Thoracic Wall.—The lungs during life are always in accurate contact with the internal surface of the thoracic wall. Each lung is irregularly conical, with its broad, semi-lunar base resting on the diaphragm. The blunt apices, which are separated from the first portion of the subclavian artery (which grooves them) by the pleura, reach to the height of a point about $1\frac{1}{4}$ to 2 inches (3 to 5 centimètres, Leitz) above the clavicle, between the two heads of the sterno-mastoid. They may be mapped

out by drawing a curved line, convex upwards, following at first the clavicular origin of the sterno-mastoid, and carried over to meet the anterior border of trapezius, and then downwards and backwards to the seventh cervical spine.

A resonant note is often obtained two inches above the clavicle, but only by percussing in a downward direction upon the apex.

The anterior margins gradually approach each other until, at the level of the second cartilage, the pleuræ alone separate them; from this point they run down the middle of the sternum, parallel to each other, as far as the fourth cartilage. The right lung continues in the same direction, as far down as the sixth cartilage; but the left, which is deeply notched for the reception of the apex of the heart, runs outwards, and follows the upper line of the absolute cardiac dulness.

The lower margins of the lungs, of course, vary with respiration, but they are sufficiently correctly mapped out by a line drawn obliquely round the sides of the thorax, from the sternal articulation of the sixth cartilage, to the spine of the tenth dorsal vertebra (*i.e.*, the eleventh rib). Such a line traverses the lower border of the sixth rib in the mammillary line (a vertical line through the nipple), the eighth rib in the axillary line (opposite the posterior fold), a point between the ninth and tenth ribs in the scapular line (a line carried ver-

tically downwards from the lower angle of the scapula, the arms hanging naturally), and the eleventh rib opposite the vertebral column.

The Left Lung is divided into two lobes by a fissure running obliquely inwards and upwards from the outer surface, to within a short distance of the root. It is somewhat narrower and longer than the right, narrower on account of the heart on the left side, longer because the liver lifts the diaphragm a little higher on the right. The relative position of the fissure is that of a line beginning behind, at the second dorsal spine, running downwards and forwards round the chest, and reaching the sixth rib in the mammillary line.

The amount of lung above and below this line, represents the upper and lower lobes respectively.

The Right Lung has two fissures dividing it into three lobes : one passing from above the middle of the external surface, and the other from near its lower end, both converging towards the root. The three lobes are mapped out externally by drawing lines following the courses of the fissures. One such line begins behind at the second dorsal spine, runs downwards and forwards round the chest, reaching the sixth rib in the nipple line ; the other begins from a point in the middle of the line last described, and extends to opposite the fourth chondro-sternal articulation.

In the axillary line a difference of over three inches can be made out between a full inspiration and a full expiration in the inferior margins of the lungs.

In percussing the front of the chest from above downwards a clear note is obtained, until we reach the liver dulness on the right side (the upper border of the fifth rib), and the relative cardiac dulness on the left side.

In percussing posteriorly, make the patient bend forwards and cross the arms in front, the scapulæ are then separated to the utmost. The tympanitic lung note is obtainable down to the tenth or eleventh rib.

In the axillary regions the lung note ceases below at the liver dulness on the right side, and at that of the spleen on the left.

The note on the right side is usually slightly duller than that on the left, owing to the usually superior muscular development on that side.

The Pleuræ.—The extent of the pleura is greater than that of the lung which it covers, except after the greatest possible inspiration; and it can be roughly mapped out by following the margins of the lungs, and exceeding these by a little under an inch.

Inferiorly the pleuræ do not quite reach the attachments of the diaphragm, but leave a portion of its circumference in contact with the costal parietes.

The limits of the pleuræ vary a little on the two

sides, on account of the greater height of the diaphragm on the right side. They may be thus compared :—

<i>On the Right Side.</i>		<i>On the Left Side.</i>
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a. IN THE VERTEBRAL LINE.

The lowest limit reaches the twelfth rib at its junction with the twelfth dorsal vertebra.		The lowest limit reaches the twelfth rib at its junction with the twelfth dorsal vertebra.
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b. IN THE MID-AXILLARY LINE.

Reaches the lower edge of ninth rib.		Reaches the lower edge of tenth rib.
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c. IN THE FRONT OF THORAX.

Reaches the seventh costal cartilage at its junction with the rib.		Reaches below the junction of the seventh rib with its cartilage.
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Relative Anatomy of the Roots of the Lungs.—The root of the right lung lies behind the superior vena cava, and part of the right auricle, and below the great azygos vein which arches over it to enter the superior vena cava ; that of the left lung passes below the arch of the aorta, and in front of the descending aorta. The phrenic nerve descends in front of the root of each lung, and the vagus behind. The bronchus is on a plane posterior to the great vessels. On the right side,

the undivided portion of the bronchus is altogether above the right pulmonary artery; on the left side, it extends to below the level of the left pulmonary artery, which crosses it. On both sides the pulmonary veins are below their corresponding arteries.

The Thoracic Portion of the Trachea bifurcates opposite the body of the fifth dorsal vertebra. It is covered in front by the manubrium sterni, with the sterno-hyoid and sterno-thyroid muscle, lower down by the left innominate vein, then by the commencement of the innominate artery and the left carotid, which pass round to its sides, and lastly by the arch of the aorta, and the deep cardiac plexus of nerves. Placed between the pleuræ, it has on its right the pleura and vagus, and on the left the left carotid artery, the vagus, and its recurrent branch, together with some small cardiac nerves.

THE ABDOMEN.

The abdomen, for clinical purposes, is divided into nine regions by two horizontal and two vertical lines. The horizontal lines are described, one at the level of the lowermost part of the thoracic wall on each side (the lower margin of the ninth rib), and the other at the level of the highest points of the iliac crests. The two vertical lines on either side pass upwards from the

centre of Poupart's ligament (these reach the thorax at the seventh cartilage). The three middle spaces are named from above downwards, epigastric, umbilical, and hypogastric ; and those on either side, the hypochondriac, lumbar, and iliac. The viscera which underlie the several regions are given in the following table from Quain's "Anatomy."

*Epigastric
Region.*

The greater part or whole of the left lobe and part of the right lobe of the liver with the gall bladder, part of the stomach, including both orifices, the first and second parts of the duodenum, the pancreas, the upper or inner end of the spleen, parts of the kidneys, and the supra-renal capsules.

*Right
Hypochondriac.*

The greater part of the right lobe of the liver, the hepatic flexure of the colon, and part of the right kidney.

*Left
Hypochondriac.*

Part of the stomach, with the greater portion of the spleen and the tail of the pancreas, the splenic flexure of the colon, part of the left kidney, and sometimes a part of the left lobe of the liver.

Umbilical.

The greater part of the transverse colon, the third part of the duodenum, some convolutions of the jejunum and ileum, with portions of the mesentery and great omentum, and part of both kidneys.

Right Lumbar.

The ascending colon, part of the right kidney, and part of the ileum.

Left Lumbar.

The descending colon, part of the left kidney, and part of the jejunum.

Hypogastric.

The convolutions of the ileum, the bladder in children, and if distended, in adults also, the uterus when in the gravid state, and behind, the sigmoid flexure and upper part of the rectum.

Right Iliac.

The cæcum, with the vermiform appendix, and the termination of the ileum.

Left Iliac.

The sigmoid flexure of the colon, convolutions of the jejunum and ileum.

The umbilicus corresponds to the tip of the third lumbar spine, and is a little below the centre of a median vertical line down the abdomen. The operation of "*Paracentesis Abdominis*" should be mentioned here, for the physician may at any time be called upon to perform it. The trochar is entered, the skin being previously pinched up, and punctured with a scalpel, as in "*Paracentesis Thoracis*," about two inches below the umbilicus in the middle abdominal line. The bladder should have been emptied before the operation. As the fluid escapes, pressure must be made upon the abdomen by means of a broad flannel roller, split at the ends to within eight inches of the middle; the broad untorn part is placed over the front of the abdomen, the four ends cross each other posteriorly, and an assistant on either side uses gentle traction, and thus pressure is kept up as the fluid escapes.

Should it be thought desirable to tap in any other direction, the position of the epigastric vessels should be borne in mind, *i.e.*, from close to the inner side of a point midway between the anterior superior iliac spine and the symphysis pubis, upwards and inwards in the direction of the umbilicus.

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THE LIVER

Lies for the most part under cover of the ribs, and in healthy *adults* its lower margin is seldom to be felt projecting from below them on the right side, even in very thin subjects, whereas in *children* it is generally an easy matter. In percussing, it should be borne in mind that the organ moves with respiration, and with changes in position of the individual. A deep inspiration will considerably depress its usual percussion limits. Normally, only the left lobe of the liver can be made out by palpation, giving rise, as it does, to a slight feeling of resistance in the epigastric region.

The extent of the lower border, unless considered in conjunction with that of its upper border, is no guide to the size of the organ, for pathological conditions of the lungs will depress the liver as a whole, or allow it, on the other hand, to rise.

The *Gall Bladder* is situated behind, and sometimes projects a little beyond, the tip of the ninth cartilage, just at the outer edge of the rectus, on the right side. Its upper surface lies against the under surface of the right lobe of the liver. Its under surface, covered by peritoneum, has the first part of the duodenum, the hepatic flexure of the colon, and sometimes the pyloric end of the stomach, in relation with it. The fundus

is also covered by peritoneum, and has in front of it the abdominal parietes, and behind, the transverse colon at its commencement.

The gall-bladder can occasionally be felt as a small tumour descending from the lower margin of the liver, in the position indicated, and gall stones may rarely be felt.

The Position of the Liver relatively to the Parietes.—That part of the liver which reaches highest under the vaulted diaphragm is, of course, separated from the chest wall by a wedge of lung tissue, and this much of the organ can only be defined by a “relatively” dull note. In percussing therefore from above downwards on the right side, in the nipple line, the clear lung note usually becomes impaired at about the level of the superior border of the fifth rib (“upper limit of relative hepatic dulness”), and here, in consequence, is the upper border of the liver. In percussing downwards, for about three inches, one next comes to the commencement of complete dulness (“the absolute hepatic dulness”), and this corresponds of course with the inferior margin of the right lung, which has already been traced out. The thin lower margin is readily detected, on account of the tympanitic resonance of the adjacent organs ; it commences close to the cardiac apex, and descends to the right, midway between the ensiform cartilage and the umbilicus, meet-

ing the margin of the ribs in the mammillary line ; from this point, backwards to the axillary line, it exceeds, by half an inch as a rule, the lower margins of the ribs.

The liver behind, opposite the tenth and eleventh dorsal vertebræ, is uncovered by lung, and this corresponds to the Spigelian lobe.

The average dimensions of the different segments of the organ are :

In the median line, 5·62 centimètres.

„ mammillary „ 12·64 „

„ axillary, „ 10·57 „

„ scapular „ 9·11 „ (Monneret.)

Relative Anatomy.—The upper surface, covered by peritoneum, is exactly moulded to the under surface of the diaphragm. The under surface, also invested with peritoneum, lies, as to the left lobe, on the subjacent cardiac part of the stomach, and over that part of the anterior surface of the stomach next to the lesser curvature. The under surface of the right lobe is divided by the gall bladder and its fossa into two unequal parts. Of these, the lateral one is by far the larger, and rests upon the hepatic flexure of the colon anteriorly, and the right kidney posteriorly. The mesial one is immediately over the pyloric end of the stomach, and the commencement of the duodenum.

The posterior surface comprehends :—a portion of the left lobe, which lies immediately in front of the

cardia, and projects over the lesser curvature of the stomach ; the Spigelian lobe, and the caudate, the former resting against the crura of the diaphragm, especially the right, the latter running behind the portal fissure, and lying immediately over the foramen of Winslow ; and a strip of the right lobe, notched at its lower and mesial corner, by the right supra-renal capsule, and resting against the ascending part of the diaphragm.

THE STOMACH

lies in the left hypochondriac and epigastric regions ; the anterior surface being partly covered by the liver and diaphragm above, and lower down, in the epigastric region, only by the abdominal parietes. Its long axis runs obliquely, for it is considerably higher on the left side than on the right.

The superior border of the stomach lies close to the lower border of the left lung, its inferior border coinciding with the transverse colon.

When empty, it is generally said to retreat behind the liver, and lie flat in front of the pancreas at the back of the abdomen, but recent observations, made by Jaschtschenko, disprove this collapse and falling back of the empty viscus, "for it is always, under these circumstances, distended with air."

When the stomach is distended, the great curvature is elevated, and at the same time carried forwards, whilst the anterior surface is turned upwards, and the posterior surface downwards (Braune).

Its relative position to the Parietes.—This is not influenced by respiration. If the organ be full of food, it is impossible to define it, but, under favourable circumstances, it is easy to distinguish its long and low-pitched percussion note from those in the neighbourhood. Owing to the position of the stomach, it is only possible to define satisfactorily the line of the great curvature, and this is facilitated by first making out the surrounding organs. The normal stomach note should not be heard half-an-inch beyond the middle vertical line of the abdomen, or lower down than the level of the umbilicus.

In mapping out the organ, it is convenient to first localise the two orifices.

The cardiac orifice, placed far back, in front and to the left of the body of the ninth dorsal vertebra, lies behind the seventh costal cartilage, one inch to the left of the sternum.

The pylorus is from two to three inches below, and a little to the right of, the base of the ensiform cartilage (about on a level with the cartilage of the eighth rib); posteriorly, it corresponds to the right side of the twelfth dorsal vertebra. If the stomach be not dis-

tended, it is only very slightly to the middle line, but when this is the case, it may extend to nearly three inches to the right. A line drawn from one orifice to the other, round the ensiform cartilage, will indicate the lesser curvature. The great curvature, starting from behind the apex-beat, runs downwards, and slightly inwards, to the level of a line joining the tips of the ninth ribs (which is also the line separating the umbilical from the epigastric region), and from this lowest point it curves with a slight outward convexity up to the pyloric orifice.

Relative Anatomy.—The stomach lies immediately behind the anterior abdominal wall, above the transverse colon, and below the liver and diaphragm. Its pyloric end lies in contact with the abdominal wall, the under surface of the liver, and the neck of the gall-bladder.

Its anterior surface looks upwards and forwards, and is in relation with the diaphragm, the under surface of the left lobe of the liver, and the abdominal parietes in the epigastric region.

The posterior surface lies against the pancreas and great vessels of the abdomen, the crura of the diaphragm, and the solar plexus; also, on the left side, the kidney and its supra-renal capsule, and the spleen.

THE SMALL INTESTINE, *i.e.*, THE DUODENUM
JEJUNUM AND ILEUM.

The intestines, below the stomach, are covered more or less completely by the great omentum. The coils of the small intestine occupy the anterior and middle part of the abdomen, below a horizontal line at the level of the umbilicus ; those of the jejunum being principally above, and those of the ileum below.

THE DUODENUM is the beginning of the small intestine ; it commences at the pylorus, and is arranged in a horse-shoe form, which embraces the head of the pancreas, far back in front of the vertical column.

The first, or ascending portion, it will be remembered, rises from the pylorus upwards, backwards, and to the right, as far as the neck of the gall-bladder. It is two inches in length, and completely covered by peritoneum. Above, and in front of it, are the liver and neck of the gall-bladder, and behind it are the vessels running between the layers of the lesser omentum (*i.e.*, hepatic artery and duct, and the vena porta).

The second, or descending portion, is three inches in length, and covered only by peritoneum on its anterior surface ; it extends from the neck of the gall-bladder, straight down in front of the right kidney, to the level of the third lumbar vertebra. In front of it

are the right arch of the colon, and the meso-colon ; and behind, it is connected to the front of the right kidney and its vessels, and the inferior vena cava, by areolar tissue. To the inner side is the head of the pancreas and ductus communis choledochus. Both the common bile and pancreatic ducts open into this part.

The third, or transverse portion, crosses the spine obliquely upwards to the level of the left side of the second lumbar vertebra, and it is here therefore that the jejunum commences. In front (at some distance) are the descending layer of the transverse meso-colon, and it is crossed by the superior mesenteric vessels ; behind it are the aorta, the vena cava, and the crura of the diaphragm ; above it are the lower border of the pancreas, the superior mesenteric vessels passing forward between the two.

THE LARGE INTESTINE.

The Cæcum lies comparatively superficial in the right iliac region.

The ascending colon, and the hepatic flexure of the colon, are deeply placed in the right lumbar and hypochondriac regions ; it passes up vertically along the outermost part of the right kidney ; that part of the intestine which is in contact with the abdominal wall

being placed immediately behind a vertical line, beginning at the central point of the iliac crest.

The transverse colon, at each of its extremities, is situated deeply towards the back part of the abdominal cavity, but in the middle it curves forwards, and lies close to the abdominal wall; it crosses the abdomen in the upper part of the umbilical region, the inferior border being generally at the umbilicus. The superior border, which is six centimètres higher, lies at a distance of four centimètres below the sternum. In the right and left hypochondriac regions the superior border passes under the costal arch, being covered on the right side by the lower border of the thorax and the lower border of the liver, and, on the left, by the lower border of the thorax only. If the left half of the transverse colon and the upper part of the descending colon are full, the stomach being empty, a more or less dull percussion sound will be obtained over the lower part of the thorax on the left side, but above this there will be a tympanitic note up to the inferior border of the lung. If a part of the colon is empty, the stomach being full, a dull note will be obtained over the stomach, and a tympanitic note over the transverse and descending colon,—that is, when the individual is in a standing or sitting posture. When he is lying on his back, there will be a tympanitic note all over, with the exception of course of the region of the spleen.

The splenic flexure reaches a much higher level than the hepatic, and is situated behind the stomach, in the left hypochondriac region.

The descending colon lies in the hinder part of the left hypochondriac and lumbar regions, and descends along the outermost part of the left kidney to the iliac fossa, where it ends in the sigmoid flexure; the part in contact with the abdominal wall follows behind a vertical line starting from the centre of the iliac crest on the left side.

The sigmoid flexure may be detected by deep pressure in the left iliac region, as it passes over the brim of the pelvis, in thin persons, even when comparatively empty; if distended with fæces, it forms a distinct tumour in this situation.

Relative Anatomy.—*The cæcum* is situated immediately behind the anterior abdominal wall. It is covered by the peritoneum in front, below, and at the sides, but has none behind as a rule, where it is attached by areolar tissue to the fascia, covering the right iliacus muscle.

The ascending colon commences at the cæcum opposite the ileo-cæcal valve. The peritoneum covers its anterior surface and sides, and sometimes passes nearly round it. It is overlaid in front by some of the convolutions of the ileum, and posteriorly it is connected by areolar tissue to the quadratus lumborum

and right kidney. The hepatic flexure is on the right of the gall-bladder.

The transverse colon.—Its upper surface is in relation with the liver and gall-bladder, the great curvature of the stomach, and the lower end of the spleen ; its lower surface with the small intestines ; its anterior with the great omentum and parietes ; and its posterior with the transverse meso-colon.

The descending colon is covered in front and at the sides by the peritoneum. Posteriorly it is connected by areolar tissue with the left crus of the diaphragm, the left kidney, and quadratus lumborum muscle.

The sigmoid flexure has in front of it the small intestines and parietes ; behind, the iliac fossa and the muscles, &c., lining it.

The rectum, it will be remembered, commences at the left iliac synchondrosis, passes to the middle line of the sacrum and a little beyond, and finally regains the middle line. The "*upper portion*," extending to the middle of the third piece of the sacrum, is surrounded by peritoneum ; behind it are the pyriformis muscle, the sacral plexus, and the branches of the left internal iliac artery ; in front of it are the posterior surface of the bladder, the uterus, and small intestines. The "*middle portion*," which has peritoneum in front and at the sides only, extends to the tip of the coccyx ; in front of it are the trigone, the vesiculæ seminales, the vasa deferentia,

and the undersurface of the prostate in the male, the posterior vaginal wall in the female. The "*lower portion*," supported by the levator ani, extends to the anus, and has no peritoneal covering.

THE SPLEEN

is placed obliquely in the cavity of the abdomen, and lies on the left side, between the ninth, tenth, and eleventh ribs; its axis lying along the tenth rib. Its upper and posterior extremity is opposite the tenth dorsal vertebra, in the concavity of the diaphragm, and somewhat overlapped by the left lung; from here the spleen passes downwards and forwards, to end a little behind the extremity of the eleventh rib (*i.e.*, opposite the first lumbar spine). Its superior and anterior border is parallel with the ninth rib, while the inferior and posterior border nearly follows the eleventh rib. The inner end is about $1\frac{1}{2}$ inches from the median plane of the body, the outer nearly reaches the mid-axillary line.

Normally the organ is not to be felt, and this is for two reasons, viz., the organ is, in the first place, too soft, and, in the second, too deeply placed. Should it enlarge sufficiently to project beyond the extremity of the eleventh rib, however, it can readily be made out by palpation.

A good method of detecting the slighter degrees of enlargement is by placing one hand posteriorly, and tilting the organ up against the other hand placed over it anteriorly, or rather, antero-laterally.

As the organ increases in size, it emerges from beneath the margins of the ribs towards the umbilicus, and confirmatory evidence of the organ being splenic is furnished in some cases by the splenic notch being appreciable, and also by its moving with full respirations, and alterations in the position of the body ; these points will serve to distinguish it from a kidney enlargement.

In determining the organ by percussion, this must be done very lightly, for, if the stomach and colon be distended by food or gas, it is well-nigh impossible to do so. Percussion must be made between the mid- and posterior-axillary line.

The spleen tends to fall towards the side on which the individual lies, and since it is necessary in percussing out the *slighter degrees of enlargement* that he lies on the right side, the splenic dulness may disappear ; it is best, therefore, in these cases to let the patient stand up during the investigation.

Relative Anatomy.—It is placed in the back of the left hypochondrium, and is closely invested by the peritoneum. Its outer surface is against the under surface of the diaphragm. On its inner surface is the

gastro-splenic omentum, which contains between its layers the splenic vessels and nerves and vasa brevia ; in front, the inner surface is in relation with the great end of the stomach ; below, with the tail of the pancreas ; and behind, with the left crus of the diaphragm, and the corresponding supra-renal capsule. The upper end is connected with the diaphragm by the suspensory ligament, the lower end is in relation with the left extremity of the transverse colon, and its posterior surface with the left kidney.

THE PANCREAS

crosses the spine opposite the twelfth dorsal and first lumbar spines, three inches above the umbilicus ; the third part of the duodenum, which is just below the gland, reaches to the level of an inch above the umbilicus.

The pancreas cannot be palpated as it is covered over by the intestines, and partly by the lower edge of the liver.

Relative Anatomy.—Its *head* is embraced by the duodenum, the common bile duct being behind it, between the duodenum and the pancreas, and the pancreatico-duodenal artery descends in front between the same parts. The *tail* extends to the spleen, and is placed over the left kidney and supra-renal capsule.

The *body* is covered in front by the ascending layer of the transverse meso-colon, and the posterior surface of the stomach. The posterior surface has the following in relation with it: (*i.e.*, between it and the first lumbar vertebra)—the superior mesenteric vessels, the commencement of the vena porta, the vena cava, the aorta, the left kidney and supra-renal capsule, and the corresponding renal vessels.

The upper border is in relation with the cæliac axis, the splenic artery and vein, and to the right the first part of the duodenum and the hepatic artery. The lower border has the superior mesenteric vessels between it and the transverse part of the duodenum; to the left of these the inferior mesenteric vein ascends behind the pancreas to join the splenic vein.

THE KIDNEYS

occupy on each side a part of the lumbar, hypochondriac, epigastric, and umbilical regions. On the left side the lower margin of the organ reaches to about two inches from the iliac crest, that is, a little below the level of the second lumbar spine, or just above that of the umbilicus; the upper margin reaches to the level of the eleventh rib or eleventh dorsal spine. The right kidney is situated a little lower than the left, say from half to three-quarters of an inch.

The internal margin lies next to the spinal column, the outer is parallel to, and about two and a half inches from it.

Normally (with the exception of the right in rare cases) they cannot be palpated, and it is only when, from loose attachments, they escape from their positions, as in "floating kidney," or are considerably enlarged, that this is practical. A "floating kidney" is diagnosed from its kidney-shape and size, its great mobility, and rarely the renal artery, entering the hilus, can be felt pulsating; if the organ be grasped, a dull, sickening pain is elicited. When greatly enlarged, the tympanitic note of the colon occupies the vertical middle line of nephritic dulness. The method of percussion here does not avail us much, for the upper margins pass into the hepatic and splenic dulness, the inner lie close to the vertebral column, and the lower only just above the iliac crest. These latter can, in some cases, be made out, but generally speaking this is only possible with the *outer* borders, and the following is the best method to effect this:—Lay the individual prone, and support the anterior surface of the abdomen by cushions, then mark out the lower limits of the hepatic and splenic dulnesses in the scapular line on their respective sides. Just below these levels the tympanitic note of the colon or stomach can be made out, and now percuss inwards, when the renal dulness

will commence at about two and a half inches from the spinal column.

Relative Anatomy.—The right kidney has in relation with its anterior surface the back part of the right lobe of the liver, the descending portion of the duodenum, and the ascending colon.

The left kidney has the great end of the stomach, the lower end of the spleen, the tail of the pancreas, and the descending colon, in relation with its anterior surface.

Their posterior surfaces rest upon the crura of the diaphragm and the aponeurosis covering the quadratus lumborum muscles.

THE BLADDER.

This organ, when distended, forms a pyriform swelling above the pubis, immediately behind the parietes, and, when this distension is extreme, it may reach even above the level of the umbilicus.

Relative Anatomy.—Its inferior or pubic surface has no peritoneal covering, and lies against the symphysis and body of the pubis, and if the organ is full, the lower part of the anterior abdominal wall.

The superior or abdominal surface is quite covered by peritoneum, which in the male is prolonged also for a short distance upon the base of the bladder. In

the male this surface is in contact with the rectum, and in the female with the uterus, as well as in both sexes with convolutions of the small intestine. Each side is covered by peritoneum at its upper part.

The base or fundus is directed downwards and backwards. In the male it rests against the second part of the rectum, and is covered superiorly for a short space by the peritoneum, which is reflected from it upon the rectum; below this it is adherent to the rectum by dense areolar tissue over the "triangular space." In the female it rests against the front of the neck of the uterus and the anterior vaginal wall, both of these organs intervening between it and the rectum.

THE UTERUS

is situated in the pelvis, between the rectum and the bladder, and does not reach above the pelvic brim in the normal non-pregnant condition. Its position and dimensions are determined by the "bimanual method" of examination, for the details of which a gynæcological book must be consulted.

THE OVARIES.

In thin persons, when the abdominal walls are not too tense, or fat, the ovaries, if in their normal position,

may sometimes be caught between the fingers bimanually, at a point between the fundus uteri and the iliac crest, and distant about one and a half inches from the former. They lie just below the level of the pelvic brim.

THE GREAT VESSELS OF THE ABDOMEN.

The abdominal aorta extends from the front of the body of the last dorsal vertebra, to the left side of the body of the fourth lumbar ; it bifurcates at the level of the highest part of the iliac crest, three-fourths of an inch below, and slightly to the left of the umbilicus. Its course is therefore from the middle line at its commencement, to a little to the left of this line at its bifurcation.

Its Relative Anatomy is :—In front of it are, from above downwards, the lesser omentum, and the stomach, the branches of the coeliac axis, and the solar plexus, the splenic vein, the pancreas, the superior mesenteric, and the left renal vein, the transverse part of the duodenum, the mesentery, and the aortic plexus. Behind, it lies close to the vertebral column, but has the left lumbar veins, the receptaculum chyli, and the thoracic duct intervening.

On the right side of the vessel there are, the right

crus of the diaphragm, the inferior vena cava, the vena azygos, the thoracic duct, and the right semi-lunar ganglion ; whereas to the left there are, the sympathetic nerve, the left semi-lunar ganglion, and the left crus of the diaphragm.

Its important branches are given off at the following levels :

The cœliac axis rises opposite the lower border of the twelfth dorsal spine, that is, four and a half inches above the level of the umbilicus, in the middle line. It is covered by the lesser omentum, and has on its right side the right semi-lunar ganglion and lobus Spigelii ; on its left, the left semi-lunar ganglion, and cardiac end of the stomach ; and below, it rests on the upper border of the pancreas.

The superior mesenteric is immediately below this.

The renal arteries come off opposite the first lumbar vertebrâ, that is, three and a half inches above the umbilicus.

The inferior mesenteric is given off one inch above the umbilicus, and slightly to the left of the middle line.

THE COMMON ILIACS extend from the left side of the body of the fourth lumbar vertebra to the sacro-iliac synchondrosis, and are from two to two and a half inches in length. Their course corresponds to the upper third of a line drawn from a point three-fourths of an inch below, and a little to the left, of the

umbilicus, to a point midway between the symphysis pubis and the anterior superior iliac spine.

The right common iliac has in front of it, the small intestines (end of ileum and cæcum), the peritoneum, the sympathetic nerves, and it is crossed by the ureter near its termination ; to its outer side, is the right common iliac vein, and the commencement of the inferior vena cava.

The left common iliac has in front, the rectum and sigmoid flexure, the peritoneum, the sympathetic nerves, and is crossed by the ureter near its termination, and also by the inferior mesenteric vessels ; to its inner side, is the left common iliac vein.

The external iliac runs along the brim of the true pelvis, and its course is indicated by the lower two-thirds of a line drawn from a point three fourths of an inch below, and a little to the left of the umbilicus, to a point midway between the anterior superior spine of the ileum, and the symphysis pubis. It has in relation with it, intestines, peritoneum, and the spermatic vessels, the vas deferens, the genital branch of the genito-crural nerve, and the external iliac vein.

The internal iliac passes from the sacro-iliac synchondrosis downwards almost immediately into the pelvis, and it divides at the level of the great sacro-sciatic notch. It has in relation with it, the peri-

toneum, the ureter, the internal iliac vein, and the lumbo-sacral cord.

It will be remembered that the portal vein derives its blood from the intestines, the spleen, and the stomach, before it enters the transverse fissure of the liver.

From above downwards, then, the following structures lie behind the median vertical abdominal line :—

- (1) The Liver.
- (2) The Stomach.
- (3) Transverse colon.
- (4) Small Intestines, covered by the great omentum.
- (5) The Bladder (if distended).

THE ANATOMY OF THE HEAD AND NECK.

A few anatomical facts which more especially concern the physician are here appended.

For that rare operation of tapping, in excessive hydrocephalus, it is important to remember, in order to avoid it, that a line over the head, from the root of the nose to the occipital protuberance, indicates the position of the superior longitudinal sinus. That of the lateral sinus is indicated by a line stretching from the same protuberance horizontally, outwards and forwards, to one inch behind the external auditory meatus, where it turns downwards towards the mastoid process.

A point two inches above the zygoma, and two inches behind the level of the external angular process, marks the spot where the large anterior branch of the middle meningeal artery is leaving the deep groove which it occupies on the anterior inferior angle of the parietal bone.

The bifurcation of the fissure of Sylvius corresponds to a point one and a quarter inches behind, and a quarter inch above, the level of the external angular

process ; from this point, the anterior limb of the fissure ascends almost vertically for nearly one inch, while the posterior limb runs backwards, and a little upwards, for about three inches, and ends beneath the parietal eminence. The upper end of the furrow of Rolando is half an inch behind a point midway between the root of the nose and the external occipital protuberance ; its lower end is close to the posterior limb, and about one inch behind the bifurcation, of the fissure of Sylvius.

As those cases in which the cranial nerves are affected, either by paralysis or irritation, generally fall within the domain of the physician, a digest of their deep origin, position at the base of the brain, and function, compiled from Quain, is given for reference. This knowledge is essential in order to localise the exact seat of an intracranial tumour, etc.

Following a classification into *twelve cranial nerves* :

The first cranial, or Olfactory nerves.—These nerves furnish the sense of smell ; the olfactory bulbs lie along the under surface of the frontal lobe, and the fibres which pass from them run directly downwards, through the perforations in the cribriform plate of the ethmoid bone. Their deep origins remain uncertain.

The second, or Optic nerves, originate in the geniculate bodies, the posterior part of the thalami, and the anterior quadrigeminal bodies. They are seen on the base of the brain to course round the crura

cerebri and enter the chiasma ; in the chiasma, most of the fibres pass diagonally across to enter the optic nerve of the opposite side ; but a few fibres pass directly into the optic nerve of the same side. The nerves leave the chiasma and enter the optic foramina. They furnish the sense of sight.

The third, or Oculo-motor nerves, arise from the grey matter of the floor of the Sylvian aqueduct, in the region of the superior corpora quadrigemina ; the fibres pass forwards, through the tegmentum and the tegmental nucleus, and partly through the substantia nigra, to emerge on the under surfaces of the crura cerebri, close to the pons ; a small part of each root often emerges from between the fibres of the crura, and joins the trunk of the nerve independently. These nerves give branches to all the muscles of the orbit, with the exception of the superior oblique and external rectus, also to the sphincter muscle of the iris, and the ciliary muscle of the eyeball.

The fourth, or Trochlear nerves, arise from a nucleus in the region between the superior and inferior quadrigeminal bodies, immediately below that of the third nerve. On the base of the brain, the small nerves are seen passing round the external border of the crura cerebri. They supply solely the superior oblique muscles of the eyeball.

The fifth, or Trigeminal nerves, consist each of a

smaller motor part, and a larger sensory. They emerge from the sides of the pons Varolii, nearer to the upper than to the lower border.

The nucleus of the motor root lies just below the lateral angle of the fourth ventricle, immediately in advance of the facial nucleus, and mesial to the large sensory nucleus of the fifth. This part supplies chiefly the muscles of mastication.

The nucleus of the sensory root arises to the outer side of the motor nucleus; it imparts common sensibility to the face and the fore part of the head, as well as to the eye, the nose, the ear, and the mouth (including the greater portion of the tongue, and the upper part of the pharynx). It may possibly also confer the power of taste upon the forepart of the tongue.

This nerve has three great divisions—the ophthalmic, the superior maxillary, and the inferior maxillary; the area of supply of the ophthalmic divisions reaches, roughly speaking, down from the upper and front part of the hairy scalp to the level of the lower margin of the eyeball (the lower lid is supplied by the second division); that of the superior maxillary reaches from here down to level of the upper teeth, inclusive; that of the inferior maxillary extends to the lower border of the inferior maxilla.

The sixth, or Abducent nerves, arise from a nucleus in the floor of the fourth ventricle; their fibres run

through the substance of the pons, to issue just below that body, and immediately above the outer border of the pyramid of the medulla. They supply the external rectus muscles of the eyeball.

The seventh, or Facial nerves.—Their nuclei are at the same level as that of the sixth, but more deeply placed in the substance of the pons; the upper end of the nucleus comes nearly in contact with the motor nucleus of the fifth, so that the two nuclei are often described as one; from this, the fibres pass backwards and inwards to the floor of the fourth ventricle. They emerge from the medulla oblongata, in the outer part of the depression between the olivary and the restiform bodies.

These are the principal motor nerves of the head, for they supply the muscles of the scalp, those of the external ear, the nose, mouth, and eyelids (except the levator palpebræ superioris) and the platysma; also the muscles of the tympanum, the levator palati, and azygos uvulæ (through the large superficial petrosal nerve), and in the neck the stylo-hyoid and posterior belly of the digastric.

The eighth, or Auditory nerves, have their nuclei in the floor of the fourth ventricle; the vagi nuclei are on their inner borders below, but higher up they overlap the nuclei of the glosso-pharyngeal, and lie alongside the upper end of the nuclei of the hypoglossal. At the base of the brain the nerves appear on the outer

side of the facial, and they are closely adherent, for a short distance, to the lower border of the pons. They supply the special sense of hearing.

The ninth, or Glosso-Pharyngeals.—The nuclei of these nerves are continuous behind with those of the vagus, and in front they are somewhat overlapped by the auditory nuclei. They emerge by a series of five or six roots, attached in a vertical line to the lateral surface of the medulla, the highest being close to the auditory nerves. These nerves give branches to the mucous membrane of the tongue, pharynx, and middle ear, as well as to one muscle—the stylo-pharyngeus.

The tenth, or Vagus nerves.—Their nuclei are a continuation of the glosso-pharyngeal nuclei above, and of the accessory nuclei below. They lie immediately external to the hypoglossal nuclei. The nerves emerge from the side of the medulla to the number of twelve or more, attached in a line which is continuous with that of the glosso-pharyngeal roots. These nerves supply branches to the pharynx, œsophagus, stomach, liver, and spleen, also to the larynx, trachea, and lungs, and small offsets are given to the dura mater and external ear. Branches are also given to the heart and great vessels through the cardiac plexus, and to the remaining abdominal viscera through the solar plexus.

The eleventh, or Spinal accessories.—These arise partly in the floor of the fourth ventricle from the continuation downwards of the vagi nuclei, and partly along the whole extent of the cervical portion of the spinal cord. It is the former part which joins and is distributed along with the vagi; the latter part is accessory to the cervical spinal nerves, and supplies the sternomastoid and trapezius. The nerves emerge as a long series of roots, the upper of which are attached to the side of the medulla in a line with the posterior roots of the spinal nerves below, and the roots of the vagi above; while the lower emerge from the lateral column of the spinal cord.

The twelfth, or Hypoglossals, have their deep origin in the floor of the fourth ventricle, and emerge by a series of fine roots at the furrow between the pyramid and the olive. They supply either alone, or with branches of the spinal nerves, all the muscles connected with the hyoid bone, including those of the tongue, but with the exception of the digastric, the stylo-hyoid, the mylo-hyoid, and the middle constrictor of the pharynx. They also supply the sterno-thyroid muscles.

For information as to the different centres of the special senses, and the various motor areas, comprehensive works on the nervous system must be consulted.

The medical man is often called upon to perform tracheotomy or laryngotomy, and the following points should be borne in mind :—Tracing down the *structures in the middle line of the neck* from above downwards, one comes upon successively :—just below the symphysis of the lower jaw the central tendon of the mylo-hyoid, then the body of the hyoid bone, the thyro-hyoid membrane, the thyroid cartilage, the cricothyroid membrane and arteries (laryngotomy is performed through this membrane), the cricoid cartilage, two or three rings of the trachea, the isthmus of the thyroid gland (usually crossing opposite the third ring of the trachea), and the trachea again. (Tracheotomy is performed through the trachea either above or below the isthmus of the thyroid.)

The rima glottidis is opposite the middle of the short anterior margin of the thyroid cartilage; the lower border of the cricoid cartilage indicates the termination of the pharynx and larynx, and the commencement of the œsophagus and trachea; this corresponds posteriorly to the level of the interval between the sixth and seventh cervical spines.

The external jugular vein is sometimes opened for venesection (*i.e.*, in infantile croup, apoplexy, or extreme venous congestion of the brain or chest). If made prominent, it can be seen to commence near the angle of the jaw, and to descend nearly vertically be-

neath the platysma and skin (the fibres of the former running nearly parallel with the vein), crossing the sterno-mastoid obliquely, and reaching the posterior border of that muscle below. Near the clavicle it perforates the fascia, and terminates most frequently in the subclavian vein.

Arteriotomy is sometimes performed on the anterior branch of the temporal arteries, especially in eye affections. This artery can be felt to pulsate about one and a quarter inches behind the external angular process of the frontal bone.

The common carotid artery may be compressed opposite the cricoid cartilage, against the prominent anterior tubercle on the transverse process of the sixth cervical vertebra.

In the angle between the sterno-mastoid and the clavicle, the pulsations of the third part of the subclavian artery can be felt, and its circulation can be stopped by pressing downwards and backwards against the first rib. The artery arches up to from half an inch to one inch above the clavicle, and the pleura and lung fit into the arch thus formed. The vein lies lower, and is under cover of the clavicle.

For galvanization of the phrenic nerves, it should be remembered that these cross obliquely the anterior surfaces of the two scalenus anticus muscles, to reach their anterior margins low down; they then cross the

first parts of the subclavian arteries, and one pole of the battery is best applied over these regions, the other over that of the diaphragm.

A Table of the average weights of the most important male organs in the adult is serviceable for the *post-mortem* room; in females they weigh somewhat less.

The brain, $49\frac{1}{2}$ ounces.

The heart, 9 to $10\frac{1}{2}$ ounces.

The lungs (together), 34 to 44 ounces. The right lung is 2 ounces more than the left in weight.

The stomach, $4\frac{1}{2}$ ounces.

The liver, 50 to 60 ounces.

The pancreas, 2 to 4 ounces.

The spleen is very variable in size and weight, but the average weight is about 7 ounces. It varies from 5 ounces to 18 or 20 pounds when much enlarged.

The kidney, $4\frac{1}{2}$ ounces.

The uterus, 7 to 12 drachms.

The ovary, 60 to 100 grains.



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